

The Mammals of the Atlantica Ecological Research Station, Southern Rhodesia

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(Plates I-IV; Text-figures 1 & 2)

INTRODUCTION

THE mammals of Southern Rhodesia have been, it would seem, very well collected, and are represented in several of the world's larger mammal collections. In the National Museum of Southern Rhodesia there are approximately 10,000 specimens, the result of intensive collecting by many workers, from Selous, in the 1870's, to the present. Other good collections are to be found in the Queen Victoria Museum at Salisbury, in the British Museum and the American Museum of Natural History. But, in relation to the amount of effort expended on field work, there has been little study of these collections and published reports are few. In consequence, when I arrived in Africa to undertake mammal studies near Salisbury, my first task was to determine what species occurred in the area of my study, and then to learn what I could of the lives of these animals. My time for this project was limited and, in consequence, this report must be considered a mere step towards a fuller knowledge of the mammals of the area.

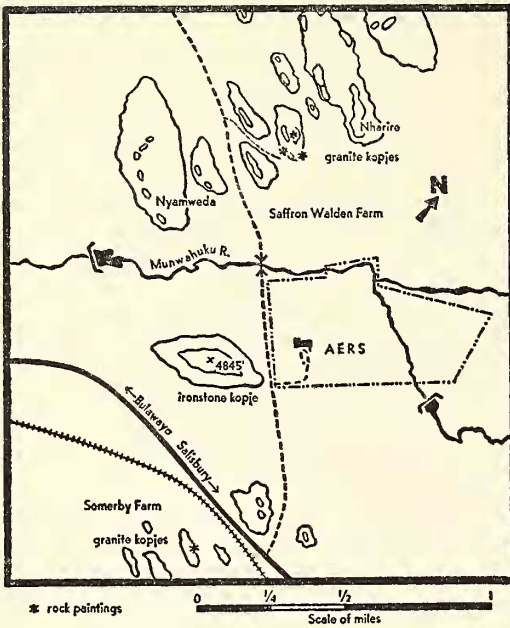
My particular aim was to study the smaller mammals of the newly-founded Atlantica Ecological Research Station, with special reference to habitat preferences, distribution, relative abundance and homing ability. Inasmuch as the field work was conducted in the end of the dry season, a time both cold and rainless, the findings would not be expected to fairly present a year-around picture. Although my wife and I were in the Rhodesias for six weeks, our trapping time at the Station was confined to four weeks, from July 21 to August 18, 1961.

THE ATLANTICA ECOLOGICAL RESEARCH STATION

The Station was established in 1960 by The Atlantica Foundation of Washington, D. C., for the purpose of providing a permanent base for research on the Central Africa biota. Its Founder and Director, Rudyerd Boulton, is a distinguished American ornithologist and Africanist. The Station lands, of 144 acres, lie at 19° South Latitude and 31° East Longitude, a half mile north of the main highway between Salisbury and Bulawayo, and 15 miles west of the first-named city. In older maps the area is shown as within Mashonaland. More recently the Station was part of the Saffron Walden Farm and in that time was grazed by cattle. Today the surrounding farms of two and three thousand acres considerably extend the habitats of the Station property, particularly the grasslands. The farms differ, however, in that they are subject to cultivation, ranching, hunting and burning. They may thus be expected to offer a somewhat different biotic spectrum than the Atlantica acres. The Station lands have been protected since 1961 by a two-strand barbed wire fence which keeps cattle from encroaching but does not hinder the ready passage of wild animals. There appears to be little or no poaching, although we found a few game snares which were presumably set by persons living on adjacent farms.

Several miles of permanent trails have been maintained on the property. The base line (Text-fig. 2—Map 2) was established subsequent to my studies.

A number of granite kopjes lie within a short radius of the Station (Text-fig. 1—Map 1). The most imposing of these kopjes, which attain a



TEXT-FIG. 1. (Map 1). The area of the Atlantica Ecological Research Station.

height of about 5,000 feet, are the Nharire hills¹ and Nyamweda hill, which lie one to two miles to the west. To the southwest of the Station is an ironstone kopje with its crest at 4,845 feet. About three miles to the south lies Lake McIlwaine, formed by the damming of the Hunyani River. A tributary of the Hunyani, called the Munwahuku,² passes through the Atlantica property (Plate II, Fig. 3). In the dry season it is represented only by intermittent pools, but during the rains it floods the lower-lying lands.

The Station is centered at a comfortable and well-staffed stone residence, with a six-room laboratory wing (Plate I, Fig. 1). In this latter are provision for small reference collections, a photographic dark room, equipment storage facilities and laboratories. The Station has a useful library. Field cars and a mobile laboratory supplement these facilities.

The African staff of the Station and their families, an average population of about 25 adults, are quartered in a compound on the grounds.

METHODS

Inasmuch as it was desired to learn something of the home ranges and homing abilities of the smaller mammals of the area, collecting was largely confined to the use of live traps. We

employed 75 metal-bodied Sherman traps of both the smallest and larger sizes, 22 Longworth aluminum-bodied traps and 5 Havaheart traps of woven wire. The last-named were set for medium-sized animals, but the sensitivity of their triggers on occasion secured us small rodents. The Longworth traps were useful only for the smaller species because the size of their doorways would not admit the larger rodents and elephant shrews. A very few guillotine traps were used to secure specimens.

Traps were set in lines at approximately ten-foot intervals, and these lines were identified by letters (Map 2). The mean number of traps set in one night was 84, the maximum 92. The total number of trap nights was 1,480.

Traps were baited with mealie meal (maize) or groundnut (peanut) butter, occasionally with raisins or fresh fruit. Sherman and Longworth traps were provided with a little kapok to serve as nest material for the captives, but despite this, on cold nights there was considerable mortality. Traps were visited as early in the morning as there was light to see by, and were usually reset and rebaited in the late afternoon. When a trap was found occupied it was taken up and immediately, or later the same day, replaced with a freshly set trap. The occupied trap and its captive were returned to the laboratory and, within the next few hours, processed, returned to the central release point, and the animal released.

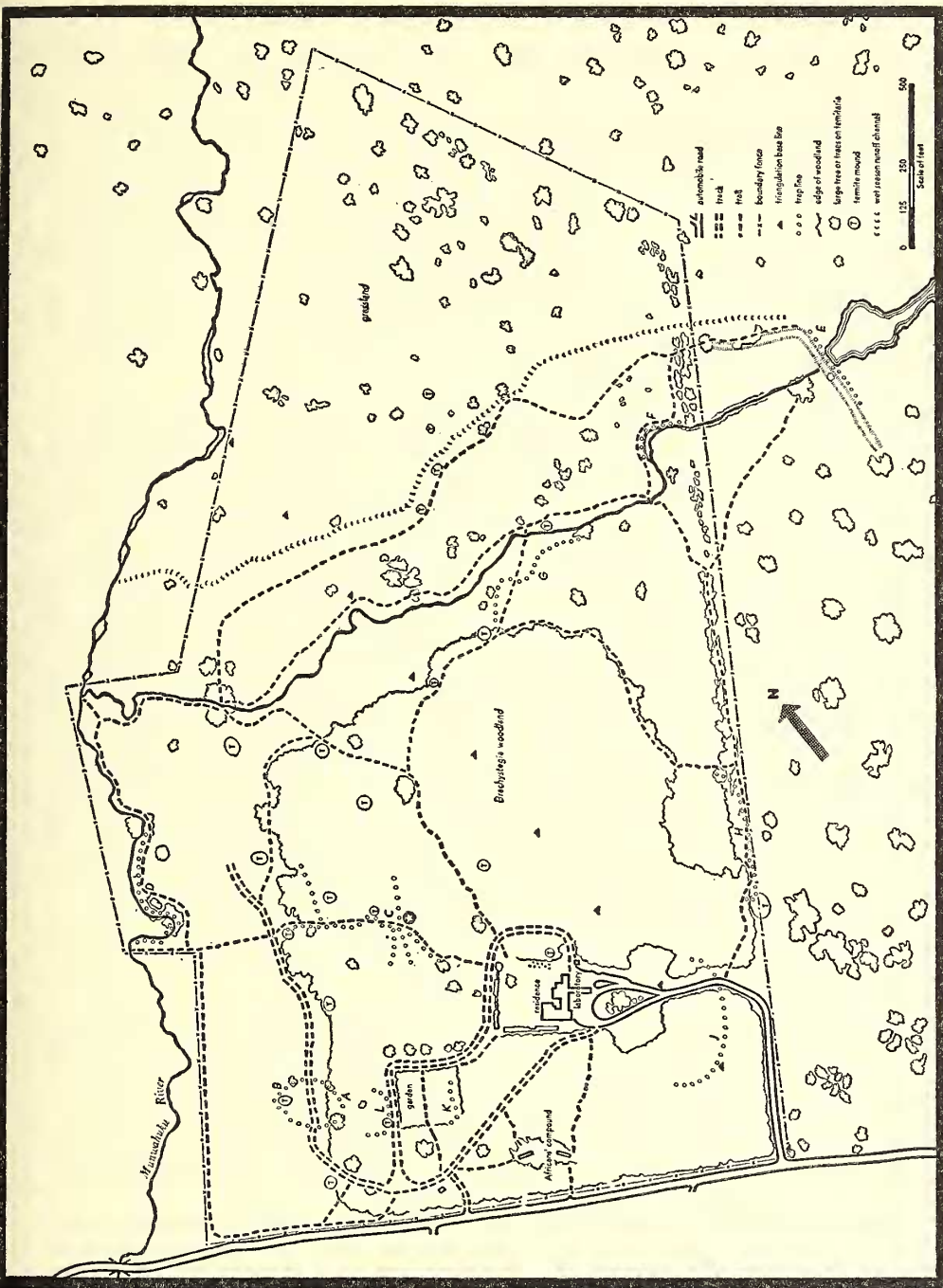
The first step in "processing" the living animal was to remove it from the trap. It was encouraged to enter a rubberized cloth bag and from that to move into a transparent plastic restraining cage. In such cages the animals could be identified, weighed and, by way of holes or slots within the walls, marked and sometimes measured for foot or tail length. These cages, manufactured by Maryland Plastics, Federalsburg, Md., were used in two sizes—small (No. 88) and medium (No. 90). A larger size was found too large for the animals being studied.

Marking the animals was generally done by the system of ear perforations, developed by Burt (1940: p. 12). This consisted of punching small circular holes with a poultry toe punch, provided by the National Band & Tag Co. of Newport, Ky. The position of the hole, or holes, on the ear margin or center, indicated the record number. In the first day's work, animals were marked by ear notching, since a punch was not then available. With some of the rodents it was found more practical to hold the animal in a gloved hand during marking than to restrain it within its plastic cage.

In the instance of the shrews (*Crocidura*) and

¹ "The high point where the sentinel watches for the enemy."

² "Where chickens drink."



TEXT-FIG. 2. (Map 2). Map of the lands of the Atlantica Ecological Research Station. The trap lines are identified with italic capital letters. The star indicates the central animal release point.

also the pygmy mice (*Mus*), ear marking was impractical and marking by nail polish was employed, but no animals so marked were recovered in our study. A duiker was provided with a numbered ear tag and a green canvas collar.

Each animal to be released was noted under

its serial number as to species, date, sex, measurements if taken, weight and point of release. In recaptures, sex and weight were checked against the record.

Except as otherwise indicated, the field measurements here published relate only to freshly dead animals that were to be prepared as study

skins. As for those species of which I obtained no specimen or for which my series was very small, Mr. Boulton's measurements are quoted. The linear measurements of living specimens were used only as a check on identification, and are not published. Few ear measurements of living animals were taken, and after we became familiar with the local species we did not measure tails or feet.

A total of 194 individuals were caught, of which 146 were marked and released. The total number of captures, including 66 recaptures, was 260.

In the accounts which follow, the number of voucher specimens added to the number of those released does not necessarily total the number of specimens handled, for in a number of instances an animal was made into a voucher specimen after recovery. The number indicated as released in each case is the number originally released; those recovered and re-released are not included in that figure. The number of vouchers we obtained is given separately from the number obtained by Mr. Boulton for the Station collection because I had no precise locality information on his specimens, and they are less useful to me in gauging relative abundance. I have, however, included Mr. Boulton's Station collection in the listing in that several species are represented in his collection which we did not obtain, and also in that all but a few pick-up specimens in that collection were shipped to me in the United States where they were studied and identified along with my own specimens.

Similarly, it is not possible to combine the number of specimens from all trap lines and obtain the figure of all specimens reported, for in the first few days of collecting, trap lines were not established and defined. Furthermore, traps set by African assistants were not always in established lines and the records of mammals thus caught were useless for certain statistics. There were also a few catches in which field identifications are open to question and those specimens are not included in this report.

Voucher specimens were obtained when animals died in the traps or were caught in snap traps. A voucher of each species was retained for the reference collection at the Atlantica Station but other specimens, both those secured during the course of my study and those earlier obtained by Mr. Boulton, are to be distributed among a few museums in Southern Rhodesia and the United States.

The maps in this report are based on tracings of aerial photographs made in August, 1960, by the Fairey Air Survey of Rhodesia, Salisbury, (Negative numbers 451 and 496, Run 12, Nor-

ton). Some trails which were not discernible on the photographs, or which were laid out at a later date, are added from field sketches and notes. The smaller scale map (Map 1) is based on my tracing of a 1:20,000 (3.168 inches = 1 mile) print; the other (Map 2), a photograph at a scale of 1:1,000 (1 inch = 80 feet). Finished maps were prepared by Patricia Hampton Kraft.

The English nomenclature which follows is chiefly that used by Ellerman, Morrison-Scott & Hayman (1953); the Konde (a tribe of Northern Rhodesia from which the collector William Ifumbe came) are names which were recorded on specimen labels by Mr. Boulton.

ACKNOWLEDGMENTS

Most grateful acknowledgment is made to Mr. Boulton, who invited me to undertake this study, and to his wife, Louise, who accepted my wife and me as part of their household and provided every facility, comfort and good counsel. To the Trustees of Cranbrook Institute of Science I am grateful for their grant of leave from my usual duties; to the New York Zoological Society for its financial support, and to Fairfield Osborn, its President, for his interest. To The Atlantica Foundation I am appreciative of additional support and the use of the facilities of its station. Above all I am thankful for the help of my wife, Suzannah, who, though not fully sharing my enthusiasm for working with small mammals, nonetheless daily assisted me in measuring, weighing and otherwise handling the living shrews, rats and mice that too often were uncooperative in our data gathering.

For the identification of three bats I owe acknowledgment to David Harrison of Sevenoaks, Kent.

I wish to thank, also, William Henry Burt of the Museum of Zoology, University of Michigan; R. W. Hayman of the British Museum; Roger Sommers of the National Museum, Bulawayo; and Graham Guy of the Queen Victoria Museum, Salisbury, for their courtesies in connection with my reference to collections in their charge and for other favors.

The last to assist, but not the least, was Margaret Fletcher, who helped ready the manuscript for publication.

THE HABITATS AND TRAP LINES

The Station lands are about equally divided between grassland and *Brachystegia* woodland (Plate I, Fig. 2). The narrow valley of the Munwahuku introduces limited habitats, and the buildings of the Station provide shelter for a few species. In places the stream is well shaded by trees, the banks precipitous (Map 2, D). In

other areas the slope to the stream bed is gentle and the banks grassy to marshy (Map 2, F). The dry season impoundments (at F, and elsewhere) are in some spots brought about by small veins of resistant rock. Just upstream from the Station a permanent pond is formed by an earthen dam. Along the southeast border fence, and beyond the margin of the woodland, is a narrow band of mature gum (eucalyptus), but these exotic trees afford no special habitat for mammals. The lawn at the residence does not hold any mammals, nor does the vegetable garden where tended, but fallow sections of this latter show abundant signs of hare, and a trap line (K) in tall, dry, herbaceous growth at the edge of the garden produced good yields.

The termite mounds, a few of which are identified on Map 2 with the letter T, are in some instances free of brush or but lightly covered, but in other instances they support large trees and candelabra euphorbias. In the area of the Station, termite mounds do not ordinarily exceed eight feet in height. Although the tree growth on these mounds in all probability does shelter some of the smaller mammals, my own trapping did not reveal this to be the case.

The stream bed in the dry season is something of a highway, for certain of the larger animals and other species come here to drink in its pools. In the areas of lush growth (as along Line F) the water rat, *Dasymys*, occurs.

The trap lines are indicated on Map 2 and identified by letters, though one, Line M, on a kopje one mile to the northwest, is too far off to be included.

The lines tend to characterize a single habitat. Thus, Lines D, E and F were streamside, but some traps in D were among trees and others in dry grass up on the banks. Lines B and K were essentially areas of high grass, but B skirted a tree-covered termite mound, and K the cleared land of the vegetable garden. Line G was in a pure grass stand, though within the area traversed the grass ranged from knee-high open stands to dense stands ten feet in height. The other lines, all within the woodland zones, traversed areas that were somewhat grassy.

The lines and their trap records are characterized and summarized as follows.

LINE A. Within the margin of *Brachystegia* woodland, where there was a ground cover of scattered brush and light herbaceous growth. Trapped: July 30-August 5. Yield: *Elephantulus*, 1; *Rattus (Mastomys)*, 2; *Mus*, 2; *Lemniscomys*, 3. *Orycteropus* diggings present. Summary: 7 nights, 100 trap nights; 4 species; 8 catches.

LINE B. Through an area of dense grass surrounding a tree and shrub-covered termite mound. Trapped: July 30-August 5. Yield: *Elephantulus*, 1; *R. (Mastomys)*, 12; *Mus*, 4. A *Civetta* scat pile and *Raphicerus* droppings occurred nearby. Summary: 7 nights, 132 trap nights; 3 species; 17 captures.

LINE C. The line centered on the central release point (Plate II, Fig. 4). This center was a bare spot in a dense stand of tall, dry "Chinese lanterns," which in itself was within the area of open *Brachystegia* woodland. All traps were set within the major forest habitat, though the canopy in much of the area did not provide over 50 per cent coverage. The records of Line L are combined with those of Line C. Trapped: July 26-July 29, August 10-12. Yield: *Elephantulus*, 1; *Crociodura hirta*, 1; *R. (Thallomys)*, 2; *R. (Aethomys)*, 8; *R. (Mastomys)*, 11; *R. (Praomys)*, 1 (a recapture); *Mus*, 1; *Lemniscomys*, 19. *Orycteropus* diggings present. Summary: 7 nights, 344 trap nights; 9 species, 8 of them as first captures; 44 captures.

LINE D. The line was established in herbaceous growth along the bank of the Munwahuku River which, during the season trapped, was represented along the trap line only by a narrow, six-foot-deep valley in which lay intermittent pools. Along part of the line a few small trees occurred and at the base of one of these, a "donkey-berry," the *Thallomys* were secured. Trapped: August 1-5. Yield: *Crociodura silacea*, 1; *Crociodura hirta*, 5; *Herpestes*, 1; *R. (Aethomys)*, 6; *R. (Thallomys)*, 3; *R. (Mastomys)*, 17; *Lemniscomys*, 3; *Dendromus*, 1. Summary: 5 nights, 85 trap nights; 8 species; 36 catches.

LINE E. Traps were set along the marshy margin of the reservoir just beyond the southeast border of the Station. All traps were set within a 2-to-10-foot-wide band of lush green vegetation on the upstream side of the dam—a band considerably trampled by cattle. Trapped: August 4-6. Yield: *Crociodura silacea*, 1; *R. (Mastomys)*, 4. Summary: 3 nights, 60 trap nights; 2 species; 5 catches.

LINE F. Within a grassy swale along the stream course, centered about 100 feet south of the southeast fence. This area is similar in vegetation to parts of Line D, but is more marshy and lacks the high banks of that section of the stream. The habitat is 15 to 40 feet wide. Runways of the small mammals were not well developed. Trapped: August 6-9. Yield: *Crociodura silacea*, 1; *Crociodura hirta*, 1; *R. (Mastomys)*, 8; *Dasymys*, 2. Pig tracks laced throughout this stand. Summary: 4 nights, 76 trap nights; 4 species; 12 catches.

LINE G. A line through an area of grass which

averaged 3 feet tall, but in some places was 10 feet. The stand lies between the woodland and the stream. Trapped: August 6-12. Yield: *Elephantulus*, 2; *R. (Mastomys)*, 6; *Mus*, 5; *Lemniscomys*, 18; *Dendromus*, 1; *Tatera*, 3. In the grass were signs of antelope and of hare. Summary: 7 nights, 261 trap nights; 6 species; 35 catches.

LINE H. A line set along the southeast fence which separates a light *Brachystegia* stand on the Atlantica Station from a grassy field in adjacent land. Trapped: July 25, August 2. Yield: *Elephantulus*, 1. The *Cephalophus* was found snared in the brush near this line. Summary: 2 nights, 17 trap nights; 1 species; 1 catch.

LINE J. Within *Brachystegia* woodland to the south of the residence. The area is essentially like that of Line C but has a closer canopy and thinner ground cover. Trapped: July 29. Yield: *R. (Aethomys)*, 4; *R. (Mastomys)*, 2; *Lemniscomys*, 2. Summary: 1 night, 45 trap nights; 3 species; 8 catches.

LINE K. The eastern periphery of the vegetable garden, within dense herbaceous growth. Trapped: July 26-29. Yield: *Crocidura hirta*, 1; *R. (Aethomys)*, 4; *R. (Mastomys)*, 7; *Mus*, 1; *Tatera*, 1. Summary: 4 nights, 80 trap nights; 5 species; 14 catches.

LINE L. The western periphery of the vegetable garden within well canopied woodland. The records of this line, in a habitat similar to that of Line C, are combined with records of the latter.

LINE M. The rocky ledges and crevices of the granite kopjes lying one mile northwest of the Station (Plate III, Fig. 5). Trapped: August 8-10. Yield: *R. (Praomys)*, 11; *Dendromus*, 1. *Procapra* had been abundant here, as attested by the large quantities of dung and other evidence. Summary: 3 nights, 53 trap nights; 2 species; 12 catches.

HABITAT PRODUCTION

A compilation of returns from the trap lines, sorted by general character of cover, indicates some differences in productivity of small mammals. The data were tabulated in relation to the number of traps set for each habitat (trap nights), by individuals of each species caught, and this latter divided by the number of trap nights to obtain the percentage of yield.

The woodland lines (A, C, J, L) yielded the lowest catches, 11.9%; the grassland lines (B, G), 13.3%; and the stream border lines (D, E, F), the best, with 24% catches. The woodland lines caught 7 species of small mammals, the grassland 6, and the streamside 9. Thus, in this sampling of late dry-season populations, it would

appear that the streamside habitats, with their generally thicker cover, greater amount of moisture, but limited area, carried both the greatest number of species and the greater density of population. The grasslands, with better cover but less diversity of plant resources, appear slightly more productive than the woodland. It would be interesting to see if these same conditions prevailed at the end of the rains.

It appears from this table that the elephant shrews occur in each habitat; that the shrews occur chiefly in the stream borders, that the rat subgenera *Aethomys* and *Thallomys* are not present in the open grasslands, that the pygmy mice inhabit chiefly the drier situations, the water rats the wet areas only, the gerbil, *Tatera*, the grasslands only, the rock rat, *Praomys*, the kopjes only. The multimammate rat (*Mastomys*) and the one-striped grass rat (*Lemniscomys*) seem ubiquitous.

Mastomys were caught 62 times and were the most abundant of the mammals; *Lemniscomys*, caught 45 times, the second most abundant. Other totals of individuals were *Rattus (Aethomys)*, 18; *R. (Praomys)*, 11; *Mus*, 11; *Elephantulus*, 6; *Crocidura hirta*, 6; *R. (Thallomys)*, 5; *Crocidura silacea*, 3; *Dendromus*, 3; *Tatera*, 3; *Dasymys*, 3; *Rattus rattus*, 1. The sampling is too small to justify correction for the number of trap-exposures per habitat, though it should be noted that woodland trap nights (Lines A, C, J, L) totalled 489; grasslands (B, G), 393; streamside (D, E, F), 221; and granite kopjes (M), 53. Obviously *Praomys*, within its restricted habitat, had a higher density of population than others with higher totals. It must also be recognized that trapping techniques were not equally suited to all species; *Elephantulus* was too large to enter the Longworth traps; *Mus* often too light to trip the traps. Other species, by reason of food interests, arboreal habit or other factors may be under-represented.

THE SPECIES

The list which follows includes those species which are known from acceptable evidence on the lands of the Atlantica Ecological Research Station or on lands within about a two-mile radius of the Station. The record includes not only animals secured in my traps, but lists as well those mammals which Mr. Boulton and his African collectors, William Ifumba and Keni Ncube, had earlier obtained, and some species, also, which Mr. and Mrs. Boulton had seen on or close by the lands. The listing does not include records from nearby areas, nor does it include those animals depicted on the rock paintings to be seen on the kopjes of adjacent farms. Many

of the animals in these "Bushmen paintings" cannot be named with certainty, but some others may be recognized without the shadow of a doubt. The Somerby Farm group, partially figured here and in Goodall, Cooke & Clark (1959: p. 12), includes elephant, hippopotamus, buffalo, hartebeest, kudu and reedbuck. On the Saffron Walden Farm kopjes one may recognize baboon, leopard, giraffe and buffalo. There is also what seems to be the birth of one of the antelopes. A white rhinoceros figure is reported in this area, but I did not see it.

Doubtless a thorough search of the literature on the pioneers would bring to light a substantially complete list of the larger species which until recently wandered over Mashonaland, but for the greater part the records are less specific than the statement of Frank Johnson (1940) who wrote that when, on September 12, 1890, he selected the site for Salisbury, he shot a lion, a teal and a Lichtenstein's hartebeest.

The list of present-day animals of the Station totals 44 species. These are divided among the Orders as follows: Insectivora, 3; Cheiroptera, 7; non-human Primates, 2; Carnivora, 7; Tubulidentata, 1; Hyracoidea, 1; Artiodactyla, 6; Lagomorpha, 1; Rodentia, 16.

***Elephantulus brachyrhynchus* A. Smith**

SHORT-SNOUDED ELEPHANT SHREW; KAROLO (Konde)

Vouchers, 4. Station collections, 5. Released, 2. Recoveries, 0.

Field measurements: Head-body*, 127-113 mm.; tail, 110-100; foot, 34-32; ear, 22-20. Weight, 60.5-38.5 grams*.

Elephant shrews were present in areas of tall grass and in the woodland. They were secured in trap lines A, B, C, G and H.

Because these elephant shrews are too large to enter the smaller-size Sherman traps or the Longworth traps, which constituted our principal collecting media, it is highly probable that the species is much more abundant than our low catch would indicate.

In the traps these shrews were quiet; when handled they made no effort to bite.

Crocidura

Two species of *Crocidura* were secured during our collecting. Of the seven individuals, all *C. hirta*, released, none was retaken.

The two species of *Crocidura* represented at the Station may be readily distinguished, when adult, on these characters:

silacea. Dorsal pelage a dark, gray-brown; below light gray; tail long (62-51 mm.; ordinarily 72% to 62% of H.-b. length); the muzzle narrow; size smaller; weight rarely exceeding 11 g. Condyllo-incisive length, 22.5-20.8 mm.

hirta. Dorsal pelage cinnamon brown; silvery gray below; tail short (rarely over 55% H.-b.), thick at base; muzzle broad; size larger; weight usually over 12 g. and to 15.7 g. Condyllo-incisive length, 24-22 mm.

***Crocidura hirta hirta* Peters**

BROWN MUSK SHREW
(Plate IV, Fig. 7)

Vouchers, 3. Station collections, 9. Released, 7. Recoveries, 0.

Field measurements, Hatt series: H.-b., 83-69 mm.; tail, 50-42; foot, 15-13; ear, 11-10. Weight, 15-12 g. Boulton series: H.-b., 100-75; tail, 52-43; foot, 14.5-11.5 (only one exceeded 13.5); ear, 11-8. Weight, 15.7-9.9 g.

The brown shrews were taken in tall herbaceous growth by the stream and in tall grass (Lines C, D, F).

***Crocidura silacea* Thomas**

GRAY MUSK SHREW; MUNKENA (Konde)

Vouchers, 3. Station collections, 7. Released, 0.

Field measurements, Hatt series: H.-b., 87-68 mm.; tail, 65-61; foot, 18-16; ear, 11-9. Weight, 11.3-9.2 g. Station series: H.-b., 89-65; tail, 60-47; foot, 16-12; ear, 10-8.5. Weight 11.2-7.5 g.

These shrews were obtained only near water, in trap lines D, E and F. The one Station specimen identified as to ecological origin is an immature specimen caught in the residence.

***Epomophorus* sp.**

EPAULETTED FRUIT-BAT

Mr. Boulton reports that during December, 1961, and January, 1962, a number of *Epomophorus* were seen hanging by day in the tops of second-growth *Brachystegia*.

***Nycteris thebaica capensis* A. Smith**

EGYPTIAN SLIT-FACED BAT; KANFIFIA (Konde)

Station collections, 3.

Field measurements: H.-b., 56-50 mm.; tail, 55-46; foot, 11-10; ear, 31-25; forearm, 45; wingspread (of one), 306. Weight, 9.5-9.1 g.

The specimens were caught in February, April and August. One was taken inside the Station residence.

* Hereafter, H.-b.; g.

Rhinolophus simulator K. Andersen
BUSHVELD HORSESHOE BAT; KANFIFIA (Konde)
Station collections, 1.

The specimen, a male, was taken March 1 in the residence.

Pipistrellus kühli Kühl
KÜHL'S PIPISTRELLE

Station collections, 1.

Field measurements: H.-b., 48 mm.; tail, 32; foot, 6.5; ear, 11; forearm, 32.5; wingspread, 230.

The specimen, an adult female, was taken January 13.

Pipistrellus rueppelli Fischer
RÜPPELL'S BAT

Station collections, 1.

Field measurements: H.-b., 45; foot, 6; forearm, 33.

The specimen, an adult male, was taken October 26. It appears to be the first record for Southern Rhodesia.

Miniopterus schreibersi natalensis A. Smith
SCHREIBER'S BAT

Station collections, 1.

Field measurements: H.-b., 56; tail, 52; foot, 12; ear, 10; forearm, 44.5; wingspread, 402. Weight, 9.2 g.

The specimen, an adult female, was taken August 4. I am indebted to Dr. David L. Harrison for identifying this specimen, which lacks the skull.

Scotophilus nigrita (?dingani) A. Smith
YELLOW HOUSE BAT

A specimen was secured by Mr. Boulton sometime after September, 1961, and reported by him to me.

Cercopithecus aethiops Linnaeus
VERVET MONKEY

Vouchers: The species is represented in the Station collection by pick-up skulls.

Vervets were seen on the granite kopjes in troops of about 15 individuals, but during our stay none were seen on Station grounds. The monkeys were active, shy and quiet. One individual was seen eating the dry seed of a *Brachystegia* or an *Isobertlinia*.

Papio ursinus Kerr
CHACMA BABOON

Vouchers: The Station collection contains pick-up skulls.

A troop of baboons was seen on one of the nearby kopjes during July, and Mr. Boulton tells me that these animals occasionally move across the Station lands in the course of their wanderings.

Canis adustus Sundevall
SIDE-STRIPED JACKAL

On two occasions jackals were heard at night; Mr. Boulton reports this as the species present. Subsequent to our departure two young jackals were taken, later to be transferred to a zoo on the Island of Jersey.

LUTRINAE

An otter, probably the commoner *Lutra maculicollis* Lichtenstein, but possibly *Aonyx capensis* Schinz, had been a frequent visitor to the Station, for dung was common near the stream. No individual nor tracks were seen, but the slides down the bank indicated that the animals were present into the dry season.

The scats were 20 to 25 mm. in diameter and averaged about 75 mm. long. At least three-quarters of their contents were small bits of the exoskeletons of crabs, but I also recovered a mandibular tooth row of the vleimuis, *Otomys*, and masses of hair of this species. Some long, broad blades of grass were present, as was a large cocoon of an ant, and the exoskeleton of a beetle larva.

Viverra civetta Schreber
CIVET

Civet dung was commonly encountered along the trails of the Station. On a small barren mound which rose about 250 mm. above the general level west of Station B were deposited a large number of scats of civet. Though it appeared to be an established defecating site, there were no well-marked runways through the surrounding dense grass, here about two feet high, nor was a den discovered.

The scats were about 25 mm. in diameter and to 200 mm. long, black, tapered, composed chiefly of matted mouse fur and broad grass blades. When torn apart many small bone fragments and rodent teeth were found. Objects identified were the calcaneum of a hare, *Lepus*, 11 fragments of *Mastomys*, 6 of *Otomys*, 3 of *Thallomys*, 2 of *Dasymys*, a piece of snail shell, the head of an ant and the wing cover of a beetle.

Genetta rubiginosa Pucheran
RUSTY-SPOTTED GENET

Station collections, 1.

Field measurements of above, an adult male taken June 18, 1961: H.-b., 510 mm.; tail, 490; foot, 84; ear, 49. Weight, 2,350 g.

The circumstances of capture of the specimen are not known to me, except that William Ifumba, who secured it, had used genet dung as a lure.

A few scats believed to be of genet were collected. These were in black, or brown to gray, rosy segments, of about 10 mm. diameter and a maximum length of 75 mm. They were composed of densely felted mouse hair and small fragments of bone of rodents, but contained also pieces of the exoskeleton of a locust (Orthoptera) and the iridescent blue-black hind wing and the greenish iridescent fragments of beetles. Other items were three heads of termite soldiers and many cocoons of a large ant.

***Herpestes sanguineus* Rüppell**
SLENDER MONGOOSE

Voucher, 1. Station collections, 2.

Field measurements: H.-b., 320 mm.; tail, 270; foot, 60; ear, 23. Weight, 488 g. Station specimens (marked "immature"): H.-b., 295-275; tail, 270-250; foot, 57-55; ear, 25-24. Weight of 1, 377 g.

My specimen was secured between 9:00 A.M. and 4:00 P.M., August 1, in a trap set in a narrow strip between the water's edge and a steep bank, Line D. No embryos were present. Its stomach contained only vegetable matter. It remained aggressive, but silent for the several minutes before it was sacrificed. The young Station specimens were taken June 17 and 22.

***Proteles cristatus* Sparrman**
AARDWOLF

An aardwolf found dead on a road within a short distance of the Station was saved by Mr. Boulton and, because of its condition, buried. It was to be exhumed for inclusion in the collection.

***Panthera pardus* Linnaeus**
LEOPARD

A rancher, whose land was near the Nharire kopjes, said that no leopards had been seen there for several years, but that previous to their extirpation one of his neighbors had lost 37 calves to the leopards in one year. My informant, who had lost but two calves to leopards, regretted the removal of these cats, since they kept the baboons in check.

***Orycteropus afer* Pallas**
AARDVARK

Although no aardvark has been taken or even seen at Atlantica, evidence of the presence of the species is very clear. Some of their excavations were deep and presumably dens; many more were only shallow pits resulting from their

digging for termites; these occur in both grassland and woodland, but are most common in reddish soils within the woodland. In such an area a half-dozen pits may be present within a 20-foot radius. None were seen dug into the large termite mounds.

Where old aardvark diggings have caved in and a shallow depression formed, this depression will often be occupied by a small tree or cluster of trees or brush, and in this manner the aardvark may play an important role in forest reproduction. (Plate III, Fig. 6).

***Procavia capensis* Pallas**
HYRAX; DASSIE

Station collections, pick-up skulls.

Although dassies do not occur within the boundaries of the Station, they are common on the nearby granite kopjes, where one may see as many as 20 at one time. At their favored areas their droppings lie thick in the flat places; at long-used sunning spots or lookouts, the rough granite may be worn to a polish by the hoofs of untold generations of these small animals.

The Africans are said to capture dassies by setting a noose above a log set to bridge the distance between two boulder tops. Once noosed, the animal falls and strangles.

***Potamochoerus porcus* Linnaeus**
BUSH-PIG

Pig wallows occurred at several points along the stream bed, and it appeared from tracks that these animals came nightly to root in the damp earth. The pigs probably hide in the kopjes during the day, though one pig was seen, after our departure, on Station lands.

***Sylvicapra grimmia* Linnaeus**
COMMON DUIKER; GRAY DUIKER

Marked and released, 1. Again sighted, twice.

Field measurements: H.-b., 833 mm.; tail, 100; foot, 270; ear, 98; horn, 22. Weight, 10,000 g.

The duiker, an adult male, caught around its neck by an old wire noose, was discovered at night by virtue of its loud cries. Detained overnight in an enclosure with poultry wire walls, it became excited at the approach of persons or a dog, and cut the skin of its head in dashing against the wire. As early as possible it was picked up, measured, weighed (in a gunny sack), and given a rabbit-ear tag, No. 136. It was further provided with a green canvas collar. Released on August 10, it was sighted on the grounds by the Boultons on October 21 and December 15, 1961. It appeared in good condition and had retained its collar.

The original capture was within the wooded area near Line H.

Raphicerus sharpei Thomas
SHARPE'S GRYSBOK

Fresh droppings of grysbok were commonly seen both in the open woodlands and in the dense grass. One was flushed from its hiding in the tall grass near Line B.

Oreotragus oreotragus Zimmermann
KLIPSPRINGER

We were told that klipspringers formerly occurred on the granite kopjes, but that they have now been eliminated through hunting.

Redunca arundinum Boddaert
REEDBUCK

Mr. Boulton includes this species in his list of animals seen at the Station.

Tragelaphus strepsiceros Pallas
KUDU

Mr. Boulton has reported that a kudu has been seen crossing the Station lands.

Lepus capensis Linnaeus
CAPE HARE

Station collections, 1.

Field measurements, adult male: H.-b., 395 mm.; tail, 80; foot, 103; ear, 91.

During my stay I saw three hares. One was outside the Station at the foot of a granite kopje to the west, where it was flushed from the tall, dry grass on the edge of a garden. On another occasion an adult and a half-grown young were seen in the glare of car lights on the road bordering the Station. Pellets of hares were common about the Atlantica grounds, and particularly in evidence in the vicinity of the vegetable garden.

Cryptomys hottentotus Lesson

COMMON MOLE RAT; KAKOKO (Konde)

Station collections, 8.

Field measurements: H.-b., 153-121 mm.; tail, 17-12; hind foot (with claw?) 22-20; ear, 0. Weight (of 7), 85.9-49.8 g.

The eight specimens, all males, were taken between late May and mid-July. Mounds of excavated earth were observed in well-drained soils throughout the Station grounds.

Hystrix africaeustralis Peters
CAPE PORCUPINE

Station collections, 1 skull. Quills were occasionally encountered along the trails.

Graphiurus murinus kelleni Reuvens
FOREST DORMOUSE; KANSHENJA (Konde)

Station collections, 5.

Field measurements of 3 adults: H.-b., 109-90 mm.; tail (of 2), 71-70; foot, 19-15.5; ear, 18-15. Weight, of 1, 20.9 g.

Mr. Boulton, on October 18, discovered a nest of a dormouse in a room in the Station laboratory. It contained three young with eyes still closed but with juvenile fur well developed. One was preserved as a specimen. What was probably the same family was found by Mr. Boulton November 20, when three young, about a week old, were discovered in a box containing scrap iron. One specimen was taken in a live trap at the foot of a tree.

Rattus rattus Linnaeus
BLACK RAT; ROOF RAT

Voucher, 1. Station collections, 10.

My one immature specimen was obtained in the Compound at the Station. The largest in Mr. Boulton's series measured: H.-b., 180 mm.; tail, 190; foot, 35; ear, 23. Unweighed. The largest female, 180 × 210 × 35. Ear measurement and weight were not noted. The heaviest weight recorded, 99.7 g., was of a male with a head-body length of 155 mm.; the heaviest female, 99.0 g., with head-body measurement of 159 mm.

Rattus (Aethomys) chrysophilus chrysophilus
deWinton

RED VELD RAT; CHISJE OR CHISHYE (Konde)

Vouchers, 7. Station collections, 33. Released, 15. Recoveries, 8.

Field measurements: H.-b., 161-123 mm.; tail, 180-150; foot, 35-29; ear, 23-19. Weight 95-45 g. Fully adult specimens usually weighed in excess of 70 g.; one female of the Station series, caught May 26, weighed 102.2 g.

The veld rats were taken in the woodland and in the grasslands near the edge of the woodland. They were secured in Lines A, B, C, J and K. No specimen is known to have come from well within the grassland, although it is possible that one or two did so.

Five of the red veld rats were recaptured once; one, twice. The maximum distance at which any one of these was retaken after one night was about 1,000 feet; they were chiefly recaptured along Line C, within 300 feet of the point of release. Of these specimens whose point of first trapping is accurately known (several brought in by an assistant must be disregarded because the report of their point of capture was vague), there seemed to be no well-marked territoriality nor any evidence of direct return to a point of first capture. The pattern of recaptures seemed random within the major trapping area of Bra-chyostegia, limited by Lines A, C and J.

The individuals of this species generally were quiet and relatively calm while in the traps and during processing.

Breeding activity was evidenced by the scrotal position of the testes of a male secured July 25. The uterus of a female prepared July 28 was empty. An individual taken by Mr. Boulton May 26 was recorded as having 1 pair of pectoral mammae and 2 pair abdominal.

Rattus (Thallomys) damarensis damarensis
deWinton

[*Rattus paedulus damarensis* Ellerman,
Morrison-Scott & Hayman]

BLACKTAILED TREE RAT; SONZHE OR SOINSJU
(Konde)

Vouchers, 3. Station collections, 7. Released, 4. Recovery, 1.

Field measurements of 2: H.-b., 148-133 mm.; tail, 162-155; foot, 29-28; ear, 23-21. Weight, 74-69 g. Weight range of 6, 85-42. Mr. Boulton notes of one that mammae were 1 pair pectoral, 2 pair abdominal.

My specimens were caught only at bases of small trees. Two of the mice were caught under a "donkey-berry tree" (*Grevia* sp.) growing on a small termite mound, Line D, streamside, and another nearby. The four others were trapped in the woodland of Line C. The one return was caught within 60 feet of its original capture point and within 10 feet of its release point, one day later.

One male and one female *Thallomys* were held captive for a few days and, after a day in separate cages, were placed together in one. Within a few minutes they went into a rough-and-tumble fight in which the male came out second best, and was not permitted into the nest box, which had been his. The female, throughout the time of their shared confinement, was always the more aggressive and nervous, often giving evidence of this in chattering her teeth. When handled she struggled very much more than did the male.

These handsome large rats, during their time in cages, fed readily on mealies, raisins and apples, and drank water.

Rattus (Mastomys) natalensis microdon Peters
MULTIMAMMATE RAT

Vouchers, 12. Station collections, 28. Released, 68. Recoveries, 41. Of the 29 individuals involved in recoveries, 20 were recaptured once, 7 twice, 1 three times, and 1 four times. Total number of trappings of *Mastomys*, 114. Total individuals, 73.

Field measurements of the 12 specimens: H.-b., 112-80 mm.; tail, 106-89; foot, 25-22; ear, 20-16. The H.-b. and tail measurements tend to be equal, or the tail to be somewhat shorter. Weight, 35-18 g. Weight range of 64 released specimens, 60-13 g. Of these the only one exceeding 45 g. was a 60 g. specimen caught inside the residence. Only two others exceeded 39 g. The mean for all other adult specimens was 25 g. Of Mr. Boulton's series of 28, 4 exceeded these weights: 68.9 g., 64.8, 42.3, 41.2.

Tail, foot and ear measurements of living animals are subject to a greater degree of error than those of freshly dead specimens, but, because of the larger sampling of living animals, the following live measurements are perhaps worth record. The maximum tail length recorded was 112 mm. The normal range of mature specimens was from 105 to 95 mm. The feet ranged from 25 to 21 mm., with claws.

It is a puzzle to me how Selous measured his specimens. In the British museum, for example, there is a specimen of *R. n. microdon* which he collected in Matabeleland in 1895. His measurements are: body, 220; tail, 217; hind foot, 48; ear, 39. The corresponding millimeter measurements of the dried study skin are 90 × 103 × 25 × 20. This may, of course, be an instance of mixed labels, but I have seen others of his measurements equally confusing.

Any attempt to present abundance statistically would be misleading, for my records on trap-nights arranged by habitat are incomplete. Of the 62 *Mastomys* of which I have record of habitat at original point of capture, 24 were from streamside habitats (Lines D, E, F); 22 from grass areas (Lines B, G, K); 13 from woodland (Lines A, C, J); 2 from inside the residence and 1 from the Compound.

The pattern of recatches was fairly consistent, the mice homing well from a distance of 625 feet or more. The *Mastomys* caught five times, an adult female, was first taken on Line B; 2 nights later on Line D (about 625 feet from its first location and an equal distance from the point of release on Line C). On the 4th, 5th and 6th nights after first capture, it was retaken at the point of first taking, returning each time from the central release point.

The animal caught four times, also an adult female, first caught on Line G August 6, was recaptured on the same line and at least twice in the same trap on the three following nights, a return of at least 1,000 feet from the release point.

A female taken in the area of Line D, and released between Lines A and B, was recaptured 10

and 12 days later along Line D. Another from Line D, released at the central release point, was retaken 2 and 3 nights later in the same line.

One male, first trapped at the central release station, Line C, was taken 2 and 15 nights later from Line C. Another male taken on Line D, retaken 3 nights later in the same line, was caught the following night on Line B. Yet another was first taken in Line K, a day later on Line C, and 6 days later on Line B. The one other male taken 3 times was caught at A, released at C, recaught in 2 days at A, released at the house, and recaught within 24 hours at A.

The patterns of those caught twice were equally variable. One caught at K, released at C, was at J 3 days later, a distance of about 1,000 feet from the release point and some 300 from K. Of the 16 of which the point of first capture was recorded, only 2 were recaught on different lines from that of first record, except for 7 that were recaught in the area of release, and these as much as 14 days later. One taken within the house was retaken in the same trap 4 nights later, 500 feet from the release point.

It was my experience that in traps or cages individuals of this species chattered a great deal and bit effectively when handled. The tail casings were strong and did not slip readily in the manner of *Lemniscomys*.

Mastomys has for more than a decade been a standard biological test animal for plague. It would seem probable that it would also lend itself well to other laboratory studies because of its potentially high fertility and mastological characters. D. H. S. Davis, of the Plague Research Laboratory, Johannesburg, wrote of their laboratory reproduction (personal communication, June 1, 1951), "We usually keep between 70 and 80 pairs. In one year (1949) 600 litters were produced: 4,997 born (8.3 per litter) and 3,956 weaned (6.6 per litter). The gestation period is about 22 days. We keep them paired for life and the usual interval between litters is 26-30 days (post partum conception is fairly regular). A few breed under the age of 12 weeks, the age of greatest productivity is from 12-44 weeks, but they go on breeding for another year if they survive. Expectation of life in the laboratory is about 290 days. This figure was calculated on the history of 176 females which in their lifetime produced 1,123 litters, 8,752 born and 5,809 weaned. The average per female lifetime was 5.29 litters, and 33 young born. It was calculated that the population multiplied 1.097 times every 4 weeks (intrinsic rate of natural increase). . . . it does not become any tamer with domestication and has to be handled carefully."

***Rattus (Praomys) namaquensis arborarius* Peters**
NAMAQUA ROCK RAT; KOPJE RAT

Vouchers, 5. Station collections, 6. Released, 5. Recoveries, 2.

Field measurements: H.-b., 108-90 mm.; tail, 153-140; hind foot, 29-27; ear, 18-17. Weight (9 adults), 54-33 g.; mean, 45. One of Mr. Boulton's specimens had a tail length of 165; other measurements were largely within the range limits of my series.

All of the rock rats were originally secured on the granite kopjes to the west of the Station. They were trapped under rock ledges and in crevices, a habitat which they had shared with the dassies.

Five rock rats were released at the central release point, one mile from their point of capture and in a habitat lacking the rocks and crevices of their homeland. Two were recovered once; one four days following release within a few feet of the release point. The other was caught the night following release, some 80 feet from the release point. Inasmuch as trapping on the kopje was not continued or repeated to a time when the rats could have returned to their home territory, it is not surprising that the only recoveries were close to the release point.

***Rhabdomys pumilio* Sparrman**

FOUR-STRIPED RAT

Station collections, 3.

Field measurements, 2 adults: H.-b., 113 mm.; tail, 83-74; foot, 19.5-19; ear, 13-11.5. Weight, 43.3-40.4 g.

A female taken June 16 was lactating. The mammae were 1 pair pectoral, 2 pair abdominal.

This species, said to be a common rat in gardens in Salisbury, was not obtained in my dry-season trapping at the Atlantica Station, but is represented in the earlier collections made on or near these lands.

***Mus minutoides* A. Smith**

PYGMY MOUSE; LEGGADA

Vouchers, 7. Released, 7. Recovery, 1.

Field measurements: H.-b., 55-40 (mean, 47) mm.; tail, 45-35 (mean, 39); foot, 15-10 (mean, 13); ear, 10-8 (mean, 9). Weight, 6.7-3.4 (mean, 4.3) g.

The pygmy mice were found principally in areas of tall grass but were obtained also in the woodland fringe where there was good cover of grass and brush. Specimens were obtained from Lines A, B, C and G.

The one pygmy mouse recaught had been taken on Line B, released at C, and recaught in 2 days on Line B.

Nine of the 14 mice were taken in grasslands along lines B and G.

The species is apparently common. In the cold season individuals often succumbed in the live traps even though nest material had been provided.

These delicate little mice could be handled without gloves, although their bites were occasionally effective. Owing to their small size, transparent plastic bags were used as a transfer agent from trap to weighing cage.

***Dasymys incommutatus incommutatus* Sundevall**

WATER RAT

Station collections, 4. Released, 2. Recovery, 0.

Field measurements: Weight, 87-57.5 g. Mr.

Boulton's series: H.-b., 168-135 mm.; tail, 140-107; foot, 30.5-27; ear, 21-18. Weight, 137.6-65.1 g.

One was noted as having 2 pairs of abdominal mammae.

These vole-like water rats were obtained in the area of rank vegetation by the stream border, Line F. Runways here were not well marked and the population apparently was small.

***Lemniscomys griselda* Thomas**

SINGLE-STRIPED GRASS RAT

Vouchers, 3. Station collections, 6. Released, 29. Recoveries, 13, representing 9 individuals.

Of these recaptured, 2 were caught on 4 occasions.

Field measurements of 3: H.-b., 128-108 mm.; tail, 129-123; foot, 30-27; ear, 17-16. Weight, 62-43 g. The extreme weight range of the 31 animals put on the scales was from 80 to 42 g. One of the Station specimens, an adult male, in breeding condition, taken July 20, exceeded my series in size, its measurements being $155 \times 160 \times 30 \times 21$, weight 84.5.

Of the 24 with habitats of original capture recorded, 13 were from grassland (Line G), 8 from within the woodland (Lines A, C, J) and 3 from the streamside (Line D). In both the woodland area and the streamside there were essentially dry, grassy areas in which a grassland species would not have seemed off-limits.

Ten of the 13 *Lemniscomys* recoveries were on Line C, near the release point, and these were recaptured at intervals of 5 hours to 16 days; 7 individuals were involved. Of this group, which stayed near the release point, 5 had been taken in other areas; 4 on Line G, 1 on Line J.

One grass rat which strayed from the area of the release was an immature female which had been first caught in the grassland of Line G, sub-

sequently recaptured, first after 2 days again on Line G, again on the following day on Line C, and 2 days later again on Line C. This individual, after an initial return within 48 hours to its home territory, a distance of 950 feet, remained near the release point for at least 3 days.

Another pattern was that of a mature female, originally trapped on Line C, released on Line C, and recaptured after one day along Line J. The distance traveled from point of release was approximately 1,000 feet.

Lemniscomys, being an abundant species, provided a satisfactory return—13 recatches from 29 releases in 21 days—but the data from the catches show little consistency, two individuals having traveled considerable distances, the others having remained near the point of release despite the basic dissimilarity of habitat from their home territory. The generally grassy character of the ground cover of the terrain around the release point apparently was sufficiently like the treeless area of Line G, from which several of them came, to satisfy them.

The grass rats were generally difficult to handle, both because they struggled to escape and because of the weakness of their skins, which seemed adaptive to escape. The tail casing particularly was subject to ready parting, and on one occasion an ear came off when held; on another occasion a patch of head skin slipped off.

Fleas removed from one specimen are identified by Dr. C. Andresen Hubbard as *Ctenophthalmus calceatus* Waterston, "a common mouse flea south of the Sahara." The type host is *Rhabdomys pumilio*.

***Saccostomus campestris* Peters**

POUCHED MOUSE

Station collection, 1.

Field measurements of above, a male: H.-b., 133 mm.; tail 45; foot, 19; ear, 18. Weight, 65.3 g.

The specimen was obtained in late May in an unrecorded spot by the trapper William Ifumba.

***Dendromus mesomelas* Brants**

STRIPED TREE MOUSE

Vouchers, 3. Released, 1. Recovered, 0.

Field measurements: H.-b., 69-61 mm.; tail, 91-77; foot, 18-13; ear, 16-10. Weight, 5.9-5.1 g.

One of these tree mice was obtained in the tall grass far from any tree or shrub (Line G); two on the streamside line (D) where there were both shrubs and trees; one on the kopje (Line M).

***Otomys irroratus mashona* Thomas**

OTOMYS; VLEIMUIS

Voucher, 1. Station collections, 6. Released, 1. Recovery, 0.

Field measurements of voucher, a female: H.-b., 155 mm.; tail, 75; foot, 28; ear, 18. Weight of release, 30 g. The largest specimen in the Station series, a male, measured 171 × 79 × 26 × 20, weight, 90.4 g. Another male weighed 105.6 g.

The habitats of my two mice, caught by an assistant, as were the Station series, were not recorded.

A flea removed from the voucher has been identified by Dr. C. Andresen Hubbard as *Ctenophthalmus calceatus* Waterston.

***Tatera afra*, near *schinzi* Noack**

CAPE GREATER GERBIL; SANZA (Konde)

Voucher, 1. Station collections, 8. Released, 2. Recoveries, 0.

Field measurements of voucher: H.-b., 148 mm.; tail, 160; foot, 35; ear, 22. Weight, 98 g. Mr. Boulton's 7 adults: H.-b.; 164-133; tail, 180-142; foot, 37-31; ear, 23-21. Weight, 114.6-84.3 g.

Of three of Mr. Boulton's specimens secured in late July, it was noted that the testes were in the scrotum; a female had 1 pair of pectoral mammae, 2 pair abdominal.

The gerbils were secured in the tall grass of Line G and in similar cover on Line K.

DISCUSSION AND CONCLUSIONS

The 144 acres of woodland and grassland which, with the associated laboratory and residence, constitute the Atlantica Ecological Research Station, hold but a depauperate mammalian fauna inasmuch as the settlers who moved into Mashonaland less than a century ago virtually completed the removal of all of the larger animals, whose reduction had been well begun by the ivory hunters of earlier years. An incomplete pictorial record of this earlier fauna of large mammals is to be seen in "Bushmen" paintings on vertical rock faces in the granite hills of farms adjacent to the Station (Plate IV, Fig. 8). The smaller mammals have, however, probably been little effected, and there is no reason to suppose that either in number of species present or in total populations the picture has been materially changed except as the habitats have been altered through cultivation, pasturing or changes in patterns of burning. Fire has been controlled within the Station's boundaries since at least 1960, and unless fire spreads in from adjacent lands, or is set by intent, the Atlantica

lands will present an evolving pattern of vegetation, and with this a change in the population of small mammals.

This report constitutes a first inventory of the Station's mammals, and may serve as a basis of comparison for conditions in years ahead. Though my own trapping, limited to part of the late dry season, would be unrepresentational of the year-around picture, the species records of Mr. Boulton, included herein, greatly extend my listing of the local fauna. At present, however, ecological records are confined to my short collecting season and should be supplemented by wet season data.

A measure of the relative abundance of the species taken is distorted by several factors. The small doorways of the Longworth, and to a lesser degree, smaller size Sherman traps, excluded some of the larger species (elephant shrews, larger rats), and smaller species (pygmy mice, tree mice and shrews) may not have been heavy enough to spring some of the less sensitive traps. My failure to obtain some genera (*Rhodomys*, *Graphiurus*, *Saccostomus*) also indicates a selectivity in trapping techniques, or a scarcity of those mice. Although a number of traps were set in trees, such sets secured no specimens. No effort was made to catch the mole rat, *Cryptomys*, for it was already represented in the Station collection, and these animals are not suited to retrapping techniques employed. No effort was made to collect bats.

Live trapping and marking of small mammals permits the study of several aspects of their biology, but the analysis of home ranges, population level changes and longevity requires different methods, and time I did not have. My program involved the establishment of trap lines in different habitats and areas, marking and releasing most of the individuals, and attempting to recapture them in traps set away from the release area. This technique is adequate for determination of habitat and homing ability, and it is largely to these matters that my time was devoted. At least one other investigator has been using similar techniques with African shrews, and the study of the game animals of Africa has made great strides with the application of marking methods, but so far as I have been able to determine, the present study is the first for Africa to deal with the homing ability of this continent's smaller rodents.

The Atlantica Station, with its protected biota and continuing program, is well suited to future studies.

My findings on homing ability are in line with those of earlier investigators. In a study of the California vole (*Microtus californicus*) Fis-

ler (1962) took his rodents from a small area of grassland and released them at stations 200 to 1,000 feet distant from the home range. He reports that homing success diminished with distance and no voles returned from a distance of over 600 feet. Those that returned at all returned quickly, and distance did not seem to affect speed of return. The finding here was that returns were successful up to about six times the diameter of the hypothetical circular home range.

My returns of *Mastomys* indicate rapid return from a distance of up to 1,000 feet. *Lemniscomys*, in one instance, returned 950 feet to its site of first capture in 48 hours or less, but more frequently recaptures were in a random pattern or the animals remained in the area close to their release point. *Aethomys* gave no records of direct return to the point of capture, either remaining in the area of release or appearing at some new distant point. These records seem not unusual for small rodents, for, although Johnson (1926) found in the American deer-mouse, *Peromyscus*, that 300 feet was the normal maximum range, returns were made from as much as 600 feet. Hamilton (1937) remarked on returns of meadow voles (*Microtus*) from one-quarter to one mile, and Murie & Murie (1931, 1932) noted that of 176 deer-mice released, one returned a distance of two miles.

Burt (1940) concluded, on the basis of critical studies with *Peromyscus*, that these animals possess a homing sense of some nature. This tends to be supported in the Atlantica study, for grass-living mice traversed woodland beyond any expected home range, to return to the point of first capture.

There was evidence that in all of the small mammals trapped there was little daytime activity, for the trap lines tended in the late afternoons were almost invariably empty. The animals released away from their home grounds in mid-day, a time during which they would normally be unexposed, would seem to be subject to heavy loss by predators, but there was no evidence to substantiate that this was the case. At the point of release there was good ground cover nearby, and all animals when freed quickly disappeared.

The only evidence which I have that bears on the question of total populations is that relating to percentage of animals caught which were recoveries at the end of the period of study. Had the trapping program been so conducted that the last days of trapping had sampled all of the areas which had been trapped before, the number would have been more significant. The total number of individuals marked and released uninjured before the last day was 140. Of these,

47 were recaptured or seen (the duiker). The total number of recaptures (i.e., first and multiple recoveries) was 66. Of the 13 species marked and released, there were no recovery records for 6. Of the last 25 small rodents taken, excluding the final day, 5 were recoveries. If one tallies the releases of the rats most commonly retaken (*Mastomys*, *Aethomys* and *Lemniscomys*) and excludes again the last day's catch and those animals which were somewhat injured, the total is 106; the record of their first recapture, 44. This is a 41% return; a very high percentage considering that, by reason of shifting of trap lines, there would be little chance for some individuals to be recaptured. Each of these statistics indicates that a substantial percentage of the resident population in areas trapped was being taken.

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EXPLANATION OF THE PLATES

PLATE I

- FIG. 1. The Atlantica Ecological Research Station laboratories, 1962.
- FIG. 2. The *Brachystegia* woodland at the north corner of the lawn. Mr. Boulton stands beneath a large specimen of *Isoberlinia*.

PLATE II

- FIG. 3. The Munwahuku River, near Line G, in the dry season. July, 1961.
- FIG. 4. The release point for the marked animals on Line C. A kopje of the Saffron Walden Farm may be seen in the distance. July, 1961.

PLATE III

- FIG. 5. The Nharire hills, granite kopjes on the Saffron Walden Farm one mile to the west of the Station. The rocks on the right are at trap line M where the rock-rats, *Praomys*, were caught and where hyrax occurred until the establishment of this settlement. On these vertical rock surfaces "Bushmen" paintings may be seen.
- FIG. 6. Clusters of small trees or shrubs occupying depressions at the sites of old aardvark pits.

PLATE IV

- FIG. 7. Brown musk shrew, *Crocidura hirta*.
- FIG. 8. Hippopotamus, buffalo, antelope and hunters: "Bushmen" paintings in a rock shelter on the Somerby Farm.